#2 1 Mayer & Tallo

Jc996 U.S. PTO 10/034800 12/28/01

In the United States Patent and Trademark Office

Appn. Number:_____

Appn. Filed:_____

Applicant(s): Johs & Hertinger

Appn. Title: Spectroscopic Rotating Compensator Ellipsometer System with Pseudo-Achromatic Retarder System

Examiner/GAU:_____ 1324

Mailed: With Application

At:_____

Information Disclosure Statement

Commissioner of Patents and Trademarks
Washington, District of Columbia 20231

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon.

Following are comments on these references pursuant to Rule 98:

PATENTS

Patent to Johs et al., Serial No. 5,872,630, from which the present Application is derived as a CIP discloses a Rotating Compensator Ellipsometer System. Said 630 Patent also describes a Mathematical Regression based Calibration procedure which makes possible the use of essentially any compensator regardless of any characteristics.

Patent No. 6,666,201 to Johs, (from which the 630 Patent was Continued-in Part) is also disclosed. The focus in said 201 Patent comprises a detector arrangement in which multiple orders of a dispersed beam of electromagnetic radiation are intercepted by multiple detector systems. However; Claim 8 in the 201 Patent, in combination with a viewing the Drawings therein, provide conception of the Spectroscopic Rotating Compensator Ellipsometer, as Claimed in Claim 1 of the JAW 630 Patent and, in fact, the the 630 Patent issued in view of a Terminal Disclaimer based upon the 201 Patent.

Patent No. 5,706,212, Issued 01/06/98, and Filed 03/20/96 for an Infrared Ellipsometer System Regression based Calibration Procedure. Said 212 Patent describes use of an Substantially Achromatic Rotating Compensator and application of Mathematical Regression in a Calibration procedure which evaluates calibration parameters in both rotating and stationary components. The 212 Patent describes that 2 OMEGA and 4 OMEGA associated terms are generated by a detector of a signal which

passes through a compensator caused to rotate at a rate of OMEGA.

Patents to Aspnes et al. are Nos.:

6,320,657 B1;
6,134,012;
5,973,787; and
5,877,859.

These Patents describe a Broadband Spectroscopic Rotating Compensator Ellipsometer System wherein the Utility is found in the use of a "substantially Non-Achromatic" compensator, (see Claim 1 in the 657 Patent), and selecting a Wavelength Range and Compensator so that at least a range of 90 - 180, (see Claim 1 in the 012 Patent), degrees retardation change occurs over the wavelength range of at least 200 - 800 nm. The 787 and 859 recite that at least one wavelength in said wavelength Range has a retardation imposed of between 135 and 225 Degrees, and another wavelength in the wavelength Range has a retardation imposed which is outside that retardation Range.

Recently published PCT Application is No. WO 01/90687 A2, which is based on US Application Serial No. 09/575,295 filed 05/03/01. This Application was filed by Thermawave Inc. and specifically describes separate use of a 2 and a 4 term to provide insight to sample thickness and temperature.

Patent, No. 4,053,232 to Dill et al. describes a Rotating-Compensator Ellipsometer System, which operates utilizes monochromatic light.

Patents Nos.:

5,596,406; and
4,668,086;

to Rosencwaig et al. and Redner, respectively, identify systems which utilize Polychromatic light in investigation of material systems, were also identified.

Patent to Woollam et al, No. 5,373,359 is disclose as it describes a Rotating Analyzer Ellipsometer System which utilizes white light.

Patents continued from the 359 Woollam et al. Patent are:

Patent 5,504,582 to Johs et al. and

Patent 5,521,706 to Green et al.

Said 582 Johs et al. and 706 Green et al. Patents describe use of polychromatic light in a Rotating Analyzer Ellipsometer System.

Patent to Bernoux et al., No. 5,329,357 is identified as it describes the use of optical fibers as input and output means in an ellipsometer system.

Patent to Chen et al., No. 5,581,350 is identified as it describes the application of regression in calibration of ellipsometer systems.

Patents pertaining to optical elements, and particularly to compensators/retarders per se are:

Patent No. 4,917,461 to Goldstein, describes an achromatic infrared retarder comprised of two identical prisms in combination with a rflective surface;

Patent No. 4,772,104 to Buhrer which describes an achromatic optical filter comprised of two birefringent disks;

Patent No. 4,961,634 to Chipman describes an infrared achromatic retarder comprised of CdS and CdSe plates aligned with the fast axes thereof perpendicular to one another;

Patent No. 5,946,098 to Johs, Herzinger and Green, which describes numerous optical elements.

Patents to Johs et al. Nos.

6,118,537;
6,100,981;
6,141,102;

5,963,325;
6,084,674; and

to Herzinger et al. No. 6,084,675,

which Applications depend from Application Serial No. 08/997,311 filed 12/23/97, now said Patent 5,946,098 are also disclosed as they disclose optical elements.

Additional Patents which describe Compensators are:

Patent No. 548,495 to Abbe;

Patent No. 4,556,292 to Mathyssek et al.;

Patent No. 5,475,525 Tournois et al.;

Patent No. 5,016,980 Waldron;

Patent No. 3,817,624 to Martin; and

Patent No. 2,447,828 to West.

Patents to Robert et al., Nos.:

4,176,951; and
4,179,217;

are also disclosed as they describe rotating Birefringent elements in Ellipsometers which produce 2 and 4 components.

SCIENTIFIC ARTICLES

Regarding Articles, an article by Johs, titled "Regression Calibration Method For Rotating Element Ellipsometers", which appeared in Thin Film Solids, Vol. 234 in 1993 is also identified as it predates the Chen et al. Patent and describes an essentially similar approach to ellipsometer calibration.

An article by Jellison Jr. titled "Data Analysis for Spectroscopic Ellipsometry", Thin Film Solids, 234, (1993) is identified as it describes a method for determining the accuracy with which certain data points can be measured, which information allows adding a weighting factor to a curve fitting regression procedure as applied to a multiplicity of data points, said weighting factor serving to emphasize the effect of more accurate and precise data.

An article by Collins titled "Automated Rotating Element Ellipsometers: Calibration, Operation, and Real-Time Applications", Rev. Sci. Instrum. 61(8), August 1990 is identified as it provides insight into rotating element ellipsometers.

An article by Kleim et al. titled "Systematic Errors in Rotating-Compensator Ellipsometry" published in J. Opt. Soc. Am./Vol. 11, No. 9, Sept 1994 is identified as it describes calibration of rotating compensator ellipsometers.

Further identified as authority for Matrix Mathematics is a paper by Jones titled "A New Calculus For The Treatment Of Optical Systems", J.O.S.O., Vol. 31, (July 1941).

Identified as describing application of Mueller Matricies in Rotating Compensator Ellispometers which utilize imperfect compensators, is a paper by Hauge titled "Mueller Matrix Ellipsometry With Imperfect Compensators", J. Opt. Soc. Am., Vol. 68, No. 11, (Nov. 1978).

Papers by Schubert and Schubert et al. which describe "Generalized Ellipsometry" are disclosed as they provide insight as how to Mathematically treat depolarizing Elements are:

"Polarization Dependent Parametes of Arbitrary Anisotropic Homogeneous Epitaxial Systems", Phys. Rev. B 53, (1996);

"Generalized Transmission Ellipsometry For Twisted Biaxial Dielectric Media: Application to Chiral Liquid Crystals", J. Opt. Soc. Am A, Vol 13, No. 9 (1996); and

"Extrension of Rotating-Analyzer Ellipsometry to Generalized Ellipsometry: Determination of the Dielectric Function Tensor From Uniaxial TiO2", J. Opt. Soc. Am. A. 13, (1996).

"Analysis of Specular and Textured SnO2:F Films by High Speed Four-Parameter Stokes Vector Spectroscopy", Rovira & Collins, J. App. Phys., Vol. 85, No. 4, (1999), is disclosed as it describes use of a Rotating Compensator Ellipsometer to measure reflection Unnormalized Stokes Vectors.

A book by Azzam and Bashara titled "Ellipsometry and Polarized light" North-Holland, 1977 is disclosed and incorporated herein by reference for general theory.

As well, identified for authority regarding regression, is a book titled Numerical Recipes in "C", 1988, Cambridge University Press.

SINCERELY,

JAMES D. WELCH
REG. NO. 31,216

Form PTO-1449 (Rev. 7-80) — U.S. DEPARTMENT OF COMMERCE, PATENT AND TRADEMARK OFFICE

LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO.	SERIAL NO.
APPLICANT: Johr et al.	
FILING DATE	GROUP

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	5877263	2/1999	Johr et al	356	369	
	AB	5666201	9/1997	Johr et al	356	369	
	AC	5706212	1/1998	Thompson et al	364	525	
	AD	6320657	11/2001	Aspnes et al	356	369	
	AE	6134012	10/2000	Aspnes et al	356	369	
	AF	5973787	10/1999	Aspnes et al	356	369	
	AG	5877859	3/1999	Aspnes et al	356	364	
	AH	5373359	12/1994	Woollam et al	356	328	
	AI	5504582	4/1996	Johr et al	356	369	
	AJ	5521706	3/1996	Green et al	356	369	
	AK	5329357	7/1994	Bernoux et al	356	369	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL							
	AM							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR		WO 01/90687 A2 (Therma wave)
	AS		

EXAMINER	DATE CONSIDERED

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	5 5 8 1 3 5 6	12/1996	Chen eTal	357	365	
	AB	4 7 7 2 1 0 4	9/1988	Buhrer	358	403	
	AC	4 9 6 1 6 3 4	10/1990	Chipman eTal	358	403	
	AD	5 9 4 6 0 9 8	8/1999	Johr eTal	358	364	
	AE	6 1 1 8 5 3 7	9/2000	Johr eTal	358	369	
	AF	6 1 0 0 4 8 1	8/2000	Johr eTal	358	364	
	AG	6 1 4 1 1 0 2	10/2000	Johr eTal	356	364	
	AH	5 9 6 3 3 2 5	10/1999	Johr eTal	358	364	
	AI	6 0 8 4 6 7 4	7/2000	Johr eTal	356	364	
	AJ	6 0 8 4 6 7 5	7/2000	Herzinser eTal	356	369	
	AK	5 8 4 4 9 5	10/1895	ABB E			

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Form PTO-1449 (REV. 1-74) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTY. DOCKET NO. | SERIAL NO.

APPLICANT Toki et al

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LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	4,556,292	12/1985	McThyrsek et al	350	394	
	AB	3,817,624	6/1974	Martin	350	286	
	AC	2,447,828	8/1948	West			
	AD	4,176,951	12/1979	Robert et al	356	33	
	AE	4,179,217	12/1979	Robert et al	356	33	
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

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Form 10-6

PLEASE USE THE FOLLOWING AS FORM 1449 FOR SCIENTIFIC ARTICLES

"Regression Calibration Method For Rotating Element Ellipsometers", which appeared in Thin Film Solids, Vol. 234 in 1993.

"Data Analysis for Spectroscopic Ellipsometry", Jellison Jr., Thin Film Solids, 234, (1993).

"Automated Rotating Element Ellipsometers: Calibration, Operation, and Real-Time Applications", Collins, Rev. Sci. Instrum. 61(8), August 1990.

"Systematic Errors in Rotating-Compensator Ellipsometry" Kleim et al., J. Opt. Soc. Am./Vol. 11, No. 9, Sept 1994.

"A New Calculus For The Treatment Of Optical Systems", Jones, J.O.S.O., Vol. 31, (July 1941).

"Mueller Matrix Ellipsometry With Imperfect Compensators", Hauge, J. Opt. Soc. Am., Vol. 68, No. 11, (Nov. 1978).

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